



The provisional license: nighttime and passenger restrictions—a literature review

Mei-Li Lin*, Kevin T. Fearn

National Safety Council, Itasca, IL, USA

Abstract

Problem: Due to inexperience and inadequate driving skills, the road is a very risky place for young and beginning drivers, yet such experience and skills can only be built by increased driving and exposure to risks on the road. Graduated driver licensing (GDL) allows beginning drivers to get their initial driving experience under less risky conditions and gradually eases them into more complex driving situations. This paper reviews the literature exploring two key features of the intermediate licensing phase of GDL, nighttime driving restrictions and passenger restrictions. *Method:* Literature review. *Results:* Nighttime driving restrictions have been shown to effectively reduce the number and rate of crash involvements on the part of teenage drivers. Data suggest that having passengers in the car increases the likelihood of a fatal injury in young drivers and that this risk increases with the number of passengers. Young drivers were more likely to cause a crash when accompanied by their peers. *Discussion:* Nighttime driving and passenger restrictions are effective in decreasing injuries among teenage drivers and their passengers, especially in the context of a full GDL system. Several research questions remain to be answered in order to fully refine and optimize the impact of these provisional measures.

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Keywords: Provisional license; Nighttime; Passenger restrictions

1. Introduction

It is quite evident that driving is a very complex task and that as a result of inexperience, inadequate driving skills, and a lack of proper perception and understanding of driving safety, the road is a very risky place for young and beginning drivers. The concept of graduated driver licensing (GDL) was introduced in the mid-1970s to address this issue and has since become an increasingly popular approach to tackle the so-called “young driver paradox,” which reasons that driving experience and skill can only be built by increased driving and exposure to risks on the road. GDL allows beginning drivers to get their initial driving experience under less risky conditions and gradually eases them into more complex driving situations. A graduated licensing system generally involves three stages: (a) the first stage is a supervised learner’s period that optimally lasts for a period of at least 6 months; (b) the learner’s period is followed by an intermediate licensing phase that permits unsupervised driving only in less risky situations; and (c) finally, a full-

privilege license is made available when the conditions of the first two stages have been met.

Two key features of the intermediate licensing phase are nighttime driving restrictions and restrictions on the number of teenage passengers. While only about 15% of the total miles of 16- to 17-year-old drivers occur between 9 p.m. and 6 a.m., about 40% of their fatal crashes take place during these hours (Williams & Pruesser, 1997). Because of this alarming statistic, some form of nighttime driving restriction is generally placed upon new or teenage drivers in the hope of limiting their exposure to the higher-risk nighttime driving environment. Several investigators have examined the efficacy of nighttime driving restrictions, both in isolation and in the context of full GDL programs.

2. Nighttime driving restrictions

One of the earliest and most frequently referenced studies to assess curfew laws examined their effect in four states, Louisiana, Maryland, New York, and Pennsylvania, with strong provisions in terms of the range of ages covered, breadth of the curfew hours, and number of exceptions to

* Corresponding author. Tel.: +630-775-2283; fax: +630-285-0242.

Table 1
Curfews and nighttime restrictions

Source	Subjects	Study period	Method	Outcome measure	Results
Begg et al. (2001)	15- to 19 year-old drivers in New Zealand	1980–1995 (GDL 8/87)	Multivariate regression model used to compare crashes of pre-GDL, restricted GDL, and full GDL drivers for each GDL restriction using database created by linking police crash reports to hospital inpatient records	Proportion of crashes when the response variable was one of the driving restrictions and main explanatory variable was the type of license	Compared with pre-GDL drivers, restricted GDL drivers had a significantly smaller proportion of crashes that occurred during the nighttime curfew. Comparisons of pre-GDL and full GDL drivers indicated that full GDL drivers had a significantly smaller proportion of crashes at night, but no differences for the other restrictions (although, as full GDL holders, they were no longer subject to the nighttime restriction).
Levy (1988)	15- to 17-year-old drivers in 47 states (all but Alabama, District of Columbia, Massachusetts, and Vermont)	1975–1984	Multivariate regression model using FARS data	Log odds ratio	Curfew on 15- to 17-year-olds reduced multiple vehicle driver fatality rates by about 28% and single-vehicle driver fatality rates by about 25%. An important part of the effect of curfew laws appears to occur through their discouraging of early licensure.
Preusser et al. (1990)	13- to 17-year-olds in Michigan and Ohio cities with curfews (Detroit, Cleveland, and Columbus) versus city with no curfew (Cincinnati)	1985–1987 (GDLs: Detroit, 11/59; Cleveland, 6/76; Columbus, 1980)	Prospective study using data from all crashes in Michigan and Ohio for years 1985–1987	Motor vehicle crash injuries by time of day/age group	The results show a 23% reduction in traffic-related injury for minor teenagers during curfew hours.
Preusser et al. (1984)	16-year-old drivers in Louisiana, Maryland, Mississippi, New York, Ohio, and Pennsylvania	1978–1980 (New York, Pennsylvania, and Ohio); 1976–1980 (Louisiana, Mississippi); 1974–1978 and 1979–1980 (Maryland)	Prospective study using data from all police-reported crashes in Louisiana, Maryland, New York, and Pennsylvania (all states with curfew laws) and Mississippi and Ohio (without curfew laws)	Expected number of crash involvements from linear regression versus actual involvements in states with curfews and those without curfews	The laws were found to substantially reduce 16-year-old driver crash involvement during curfew hours: Pennsylvania (69% reduction), New York (62%), Maryland (40%), and Louisiana (25%).
Preusser et al. (1993)	13- to 17-year-olds in cities of 100,000+ population without general curfews or driver curfews for teens \leq 16 years	1984–1990	Telephone survey of cities, analysis of FARS data	Regression coefficients for log population and curfew, by time of day/age group	Cities with curfew laws had a 23% reduction in fatal injuries for 13- to 17-year-olds during the 9:00 p.m.–5:59 a.m. curfew period.
Williams and Pruesser (1997)	16- to 17-year-old drivers in the US	1984–1996	Literature review	Crash involvement rates	Although only about 15% of the total miles of 16- to 17-year-old drivers occur between 9:00 p.m. and 6:00 a.m., about 40% of their fatal crashes take place during these hours.
Williams et al. (1985)	15- to 18-year-old high school students in upstate Louisiana; upstate Mississippi; Orange County, CA; rural Colorado; Michigan; upstate New York; and New Jersey	1984	Survey	Driver licensing rates	The earlier the age at which licensing is permitted, the higher the rate of high school teenagers licensed. As licensing is delayed, the greater will be the proportion of students licensed during the first year licensing is permitted. Night driving curfews can discourage early licensure when they include the hours that teenage drivers wish to drive, such as New York's 9 p.m.–5 a.m. curfew period. Curfews with later starting times, such as Louisiana's at 11 p.m., had only a minor effect.

the law (Preusser, Williams, Zador, & Blomberg, 1984). The expected crash involvement of 16-year-old drivers without curfews was estimated using linear regression on the crash data from age groups unaffected by curfews. There were estimated reductions in 16-year-old crash involvements during curfew hours in each of the four curfew states studied, with the reductions the highest in Pennsylvania at 69%, followed by New York with a 62% reduction, Maryland with a decrease of 40%, and Louisiana with a crash reduction of 25%. One of the main reasons the actual numbers of 16-year-old driver crash involvements in curfew states were lower than the predicted numbers was that in three of the four curfew states studied, the proportion of the 16-year-old population that was licensed to drive was lower than in comparison states. This effect was not limited to the curfew hours, but was observed at all hours of the day. A survey of high school students (Williams, Lund, & Preusser, 1985) offered further evidence that nighttime driving curfews, especially those that include the hours during which many teenage drivers desire to drive (such as New York's 9 p.m.–5 a.m. curfew period), may work to delay licensure and thus reduce injuries and fatalities among this age group. Table 1 summarizes many of the studies that have evaluated nighttime driving restrictions.

The relative impact of state licensure policies, including curfew laws, was also examined using a more comprehensive data set that used the data from 47 states over a 10-year period (Levy, 1988). The effect of implementing a curfew on 15- to 17-year-old drivers was shown to result in a reduction of driver fatality rates of about 28% for multivehicle accidents and 25% for single-vehicle accidents. These findings are consistent with those of Preusser et al. (1984) and—also supported by that earlier study—further regression analysis revealed that the curfew significantly reduced the rate of licensure of the study group.

General curfews that limit the nighttime activities of teenagers in the absence of adult supervision have also been shown to reduce late night motor vehicle injury involving teenagers, even though the restrictions were not specifically developed or adopted as highway safety measures. Preusser, Williams, Lund, and Zador (1990) examined the effect of general nighttime curfews on highway injury among teenagers aged 13–17 years in cities in Michigan and Ohio—two states that do not have a general statewide driving curfew law. The estimated injury reduction in motor vehicle-related injury among teenagers across the cities with general curfews was 23%. Anecdotal reports from the curfew cities suggested that, unlike the curfew laws in many cities/communities, the curfew laws were generally known and it was concluded that they had a positive effect on the highway crash and injury involvement of minor teenagers similar to that of statewide driving curfews.

Subsequent work by Preusser, Zador, and Williams (1993) explored the effect of general curfew ordinances

for minor teenagers in 149 cities in 32 states, and again showed a 23% reduction in the number of nighttime (9 p.m.–5:59 a.m.) highway fatalities for 13- to 17-year-olds using FARS data for the period 1984–1990.

The preceding discussion has focused on the results of studies examining the effect of nighttime driving restrictions or curfews; more recent work has examined these restrictions in the context of full GDL systems. Florida was the first state to adopt the main elements of a full GDL system in 1996 and Ulmer, Preusser, Williams, Ferguson, and Farmer (2000) reported on the effects of the Florida program. Florida's nighttime curfew was found to be effective, with nighttime crash involvements of 15- to 17-year-old drivers declining on a percentage basis more than daytime crashes. This decline occurred while the number of 15- and 16-year-olds receiving licenses increased by 29% and 14%, respectively; therefore, the declines in crash involvements were not due to fewer people holding licenses.

An evaluation of the initial effects of the North Carolina GDL system (Foss, Feaganes, & Rodgman, 2001) revealed that a benefit was evident for 16-year-old drivers even though the nighttime restriction only lasts 6 months for most young drivers. Crashes involving 16-year-old drivers between the hours of 9 p.m. and 5 a.m. were 43% less likely, while daytime crashes declined by only 20%. A similar study that examined the initial impact of the GDL program in Michigan also focused on 16-year-old drivers (Shope, Molnar, Elliott, & Waller, 2001) and found a 21% reduction in the risk of evening crashes (9 p.m.–11:59 p.m.) and 53% reduction of night crashes (midnight–4:59 a.m.). Unlike the North Carolina study, where licensing declined only slightly during the study period, licensing among 16-year-olds declined by over 22% in the Michigan study and could therefore be an explanation for some of the reduction in crashes, although the reduction in night crashes exceeded the decrease in the population of 16-year-old drivers.

The effect of nighttime curfews was recently examined as part of a full GDL system in New Zealand that includes the learner, restricted and full licensing stages, restrictions on the carrying of young passengers, and blood alcohol limits (Begg, Stephenson, Alsop, & Langley, 2001). Compared with drivers in New Zealand aged 15–19 years who were licensed pre-GDL, restricted license drivers had a significantly smaller proportion of crashes that occurred during the nighttime curfew period. In addition, a comparison of the crashes of pre-GDL drivers with those who had obtained a full GDL revealed that those drivers with a full GDL also had a smaller portion of crashes at night, perhaps signifying a carryover effect from the restricted license segment of the GDL program since, as full GDL holders, they were no longer subject to the nighttime driving restriction.

As noted above, in previous evaluations of nighttime restrictions, it has often been difficult to separate the effect of the nighttime restrictions from the corresponding drop in

Table 2
GDL evaluations

Source	Subjects	Study period	Method	Outcome measure	Results
Boase and Tasca (1998)	Novice drivers (all age groups)	1993 and 1995 (GDL 4/94)	Before/after study of collision rates	Collision rate and fatal and injury collision rates per 10,000 licensed novice drivers	Collision rates for 1995 novice drivers was 31% lower than the rate for 1993 novice drivers. Decreases of similar magnitude were observed for novice drivers of both sexes and all age groups in the 1995 novice driver population. Only a 4% reduction was observed for the general driving population over the same period. While the fatal collision rate per 10,000 licensed novice drivers remained essentially unchanged, there was a 20% reduction in the fatal collision rate for novice drivers aged 16–19 years. The 1995 novice driver population reduced the social cost associated with novice driver collisions by US\$59 million.
Foss et al. (2001)	16-year-old drivers in North Carolina	1996–1997 versus 1999 (GDL 12/97)	Before/after study with control group using North Carolina crash data files	Rates of motor vehicle crashes overall and by severity, time, type, driver alcohol use, and driving environment.	Crash rates declined sharply for all levels of severity among 16-year-old drivers after the GDL program was implemented. Comparing 1996 with 1999, fatal crashes declined by 57% while crashes with no or minor injuries dropped by 23%.
Langley, Wagenaar, and Begg (1996)	15- to 19-year-old, 20- to 24-year-old, and 25-year-old and above crash victims	1979–1992 (GDLs 8/87)	Time series analysis using ARIMA	Hospital admissions due to motor vehicle traffic crashes	The introduction of GDLs was closely followed by a substantial reduction of car crash injuries among all ages, but that was most visible in the 15- to 19-year-old age group (23%). The reductions observed for the two older age groups suggest that factors other than the GDLs were operating to reduce crashes for all ages and that the reduction associated with the GDLs among the 15- to 19-year-old group was likely to be significantly less than 23%, with a conservative estimate being 7%. Licensing trends suggest that the reduction in crashes among 15- to 19-year-olds may be attributable to an overall reduction in exposure as opposed to a reduction in exposure to high-risk situations targeted by the GDLs.
Mayhew, Simpson, and Groseilliers (1999)	16- to 17-year-old drivers and all beginning drivers, regardless of age	GDL 10/94	Before/after study of crash data in Nova Scotia with comparison to trends in control jurisdictions	Number of crashes, injuries, and fatalities	Among 16-year-old drivers, there was a 24% decrease in total collisions during the first year of the program, and a 37% reduction over the first 3 years of the program. In addition, there was a 19% drop in the collision rate among all novice drivers.

Preusser, Ferguson, and Williams (1999)	16- to 17-year-old new drivers in Tennessee with comparison group of new drivers' age 18 years and older	October/November 1995 and December 1996/January 1997 (learner's permit requirement 1/96)	Survey	Pre-post law comparisons of age learner's permit was obtained, months permit was held, median hours of practice, hours with parent and miles driven, and age license was obtained	Prelicense driving and timing of obtaining a license increase driving experience, which in turn may lower crash rates.
Shope et al. (2001)	16-year-old drivers in Michigan	1996 versus 1998-1999 (GDL 4/1997)	Before/after study using Michigan crash data files, adjusting for trends among persons 25 years or older	Rates for all police-reported crashes, by severity, time of day, type, and alcohol-related	The rate of 16-year-old drivers per 1000 population involved in crashes declined from 154 in 1996 to 111 in 1999, a 25% reduction.
Ulmer, Ferguson, Williams, and Preusser (2001)	16- to 18-year-old drivers in Connecticut and six nearby New York counties	1996-1997 (GDL 1/97)	Before/after study of crash rates in Connecticut, compared with crash rates in nearby counties in New York	Crash rate ratios	Fatal/injury crash involvements of Connecticut 16-year-old drivers declined by 22% during first full year following the law change. Crash involvements for 17- and 18-year-olds in Connecticut and 16- to 18-year-olds in New York showed no significant changes.
Ulmer, Preusser, Ferguson, and Williams (1999)	15-year-old drivers in Louisiana Mississippi; 16-year-old drivers in northern Florida	1992-1995 (GDL 7/93)	Before/after study following implementation of education requirement; comparison to nearby state that also licenses drivers at age 15 years and another nearby state that licenses at age 16 years	Crash rate ratios	Crash rate ratios of Louisiana 15-year-olds declined by 20% during the first year, while the rates of other teenagers in the state and among 15- to 18-year-olds in comparison states remained unchanged or increased.
Ulmer et al. (2000)	15- to 17-year-old drivers in Florida and Alabama	1995-1997 (GDL 6/96)	Before/after study of Florida teen drivers with comparisons with Alabama (no GDL) teens and older (age 18 years) Florida teens	Crash involvement rates	There was a 9% decline in the crash rates of 15- to 17-year-old drivers in Florida following the adoption of graduated licensing. There were no significant reductions seen among Alabama teenagers or 18-year-olds in Florida.
Williams and Mayhew (2002)	16- to 18-year old drivers/ beginning drivers	1984-2001	Literature review	Crash and injury rates	In an optimal graduated licensing system, young beginners would not start until age 16 years and then they would spend at least 6 months in an initial learner's stage during which their parents would have to certify at least 30-50 h of practice. The learner's stage would be followed by an initial or provisional license stage with restrictions on unsupervised nighttime driving that begin no later than 9 or 10 p.m. and also restrictions on transporting teen passengers; each of these restrictions should last at least 6 months. Final graduation to an unrestricted license should not be permitted until at least age 18 years.

Table 3
Passenger restrictions

Source	Subjects	Study period	Method	Outcome measure	Results
Aldridge et al. (1999)	Drivers age 16–20 years in Kentucky	1994–1996	Investigation of the effect of passengers on young driver accident propensity using the quasi-induced exposure technique	Relative accident involvement ratios (RAIR)	The passenger group variable was found to have a significant effect on young driver accident propensities. Young drivers have the lowest propensity to cause single-or two-vehicle accidents with traveling with either adults and/or children, but have an increased propensity for causing single-vehicle accidents when traveling with peers. The results suggest that risk taking is a factor in young driver safety.
Chen, Baker, Braver, and Li (1999)	16- to 17-year-old drivers	1990	Prospective study of FARS and NPTS data.	Road user deaths in 1990 involving drivers ages 16–17 years transporting passengers younger than 20 years of age	The road user death rate for drivers ages 16–17 years transporting only passengers younger than age 20 years was 3.6 times the rate for drivers ages 16–17 years without passengers and 4.2 times the rate for drivers age 18 years or older carrying any passengers. Similar differences were found for 16-year-old drivers. If 16- to 17-year-old drivers were restricted from carrying passengers younger than 20 years (without any older passengers), then in the best-case scenario, when all drivers obey the law and all their passengers give up the trip, a 72% reduction in road user deaths would be expected for drivers ages 16–17 years. In the lowest compliance scenario examined, reductions of 9% in road user deaths were estimated for drivers ages 16–17 years if 80% of the drivers violate the law, 10% of the passengers drive by themselves, 0% of the passengers give up the trips, and 10% of the passengers travel with older drivers.
Chen et al. (2000)	16- and 17-year-old drivers	1992–1997 FARS and GES; 1995 NPTS	Prospective study	Driver deaths per 10 million trips by number of passengers, driver age and sex, and time of day; driver deaths per 1000 crashes by passenger age and sex	Compared with drivers of the same age without passengers, the relative risk of death per 10 million trips increased with the number of passengers for both 16- and 17-year-old drivers. The risk of death increased significantly irrespective of the time of day or sex of the driver, although male drivers were at greater risk. Driver deaths per 1000 crashes increased for 16- and 17-year-olds transporting male passengers or passengers younger than 30 years. The data support passenger restrictions in GDL systems for young drivers.
Doherty, Andrey, and MacGregor (1998)	Accident data for all accidents involving a fatality, person injury, or property damage > US\$700 in Ontario, Canada	1988 (GDL 1994)	Analysis of accident data derived from police reports and provincial travel survey for exposure data	Accident involvement rates by driver group (male/female × three age groups) and driving situation (number of passengers, time of day, and day of week); rates calculated separately for fatal, injury, and PDO accidents	Accident involvement rates of 16- to 19-year-old drivers are higher than those of 20- to 24-year-olds and 25- to 29-year-olds in all situations examined, but were disproportionately high on weekends, at nighttime, and with passengers. The negative effect of passengers on overall accident rates was found only for 16- to 19-year-old drivers. Accident involvement rates were approximately twice as high with passengers as without, and for 16- to 19-year-olds, rates were also significantly higher for two or more passengers versus one passenger. The highest rates for the 16- to 19-year-old group occurred with passengers at nighttime.

Insurance Institute for Highway Safety (1999)	16- to 17-year-old drivers	1990	Prospective study of FARS and NPTS data	Road user deaths in 1990 involving drivers ages 16–17 years transporting passengers younger than 20 years of age	If all teen passengers followed the law and 100% drove themselves rather than violating the restriction and riding with a young 16- to 17-year-old driver anyway, an estimated 275 lives would be saved. These savings would be lessened to the extent that teenage passengers violate the law and ride with a young driver anyway.
Preusser, Ferguson, and Williams (1998)	Fatal crash-involved drivers of passenger vehicles	1990–1995	Analysis of FARS data	Passenger presence in driver-at-fault fatal crashes; relative risk of fatal crash involvement by age group, time of travel, and number of passengers	Passenger presence was associated with proportionately more at-fault fatal crashes for drivers aged 24 years and younger, was a neutral factor for drivers ages 25–29 years, and was associated with fewer at-fault involvement for drivers ages 30 years and older. Relative risk of fatal crash involvement was particularly high for teenage drivers traveling, day or night, with two or more teenage passengers.
Regan and Mitsopoulos (2001)	Casualty crashes involving passengers in Australian Capital Territory (ACT)	1995–1999	Analysis of 1995–1999 ACT crash data, telephone survey, and focus groups	Frequency tabulations of ACT crash data for drivers and passengers; factor analysis of telephone survey data; summary of group discussion responses	Passengers can play a positive or negative role with a driver. From the driver's perspective, friends as passengers, 16- to 24-year-old passengers, and male passengers regardless of the sex of the driver were found to be the most likely to display a negative influence. This influence could lead to a greater propensity among drivers, especially young male drivers, to engage in risky driving behaviors. Positive passenger roles included detection of imminent dangers and giving directions.
Smith, Pierce, Upledger Ray, and Murrin (2001)	16-year-old drivers in San Diego County, CA	1997 versus 1999–2000 (GDL 7/1/98)	Before/after study of motor vehicle crash data from California Statewide Integrated Traffic Records System	Crash rate, passenger injury rate, and crashes occurring between the hours of midnight and 5 a.m.	The percentage of 16-year-olds with a driver's license was 7% lower in 1999 and 19% lower in 2000 compared with 1997 as a result of the increased waiting period to apply for the new license. The positive effects of the legislation were primarily due to the fact that fewer young drivers were on the road, rather than improved safety among licensed drivers.
Vollrath, Meilinger, and Kruger (2002)	Severe accident victims in (injuries or fatalities or material damage of about US\$1700) two-vehicle accidents in German governmental district of Mittelfranken	1984–1997	Responsibility analysis used to examine the overall effect of passengers and the influence of modifying variables	Odds ratio from logistic regression	The general protective effect of the presence of passengers was found to be reduced in young drivers, during darkness, in slow traffic, and at crossroads, especially when disregarding the right of way and passing a car. The responsibility analysis indicated an increased risk for young and older drivers as compared with middle-aged drivers.

(continued on next page)

Table 3 (continued)

Source	Subjects	Study period	Method	Outcome measure	Results
Williams and Wells (1995)	13- to 19-year-old passengers	1993 (1990 NPTS used to estimate miles traveled in 1993)	Prospective study	Driver and passenger deaths in passenger vehicles by age and gender; driver and passenger death rates by age and gender; percentage of driver and passenger deaths by hour of day and age, vehicle size/type, and occupant age, vehicle model year and occupant age; teen passenger deaths in vehicles driven by teenage drivers, by driver age and gender; and teen driver death rates per 100,000 licensed drivers, 100 million miles, and number of teen passengers killed in their vehicles	Two-thirds of teenage passengers killed in 1993 were in vehicles driven by other teenagers. More teenage passenger deaths occurred in vehicles driven by 16-year-olds than any other age, and both male and female 16-year-old drivers had greatly elevated rates of teenage passenger deaths in their vehicle per licensed driver and per mile driven compared with older teenage drivers. Results suggest that graduated licensing systems that phase in full driving privileges, restricting on-the-road experience to lower-risk settings (i.e., operation only during daylight hours or prohibition on the transportation of exclusively teenage passengers) may prove beneficial in reducing fatalities.
Williams and Shabanova (2001)	Fatally injured drivers and passengers in passenger vehicles from FARS	1995–1999	Analysis of belt use among fatally injured drivers and their passengers	Chi-square analysis of seat belt use by driving situation	For teenagers, driver belt use decreased with increasing numbers of passengers and was lowest when teenage drivers were transporting passengers in their 20s. Drive belt use was highest when transporting passengers ages 30 years or older, many of whom could be parents. Passenger belt use decreased among teenagers as the number of passengers in the vehicle increased.
Williams (2001)	13- to 19-year-old drivers and passengers	1990 NPTS; 1995, 1999 FARS	Summary review article	Fatally injured drivers and passengers; death rates for drivers and passengers by age; crash rates by driver age and passenger presence per 10,000 trips; deaths prevented by nighttime and passenger restrictions	Found an increased risk of motor vehicle accidents involving a teenage driver when teenage passengers are present. The risk is attributed to distraction and risk-taking factors.

the number of young licensed drivers. The familiar decrease in the number of licensed drivers in the 15- to 19-year-old age group occurred in New Zealand after the introduction of GDL in 1987. However, since that time, the rate of young licensed drivers has recovered to a level similar to that before GDL was implemented and yet there has still been a continued decrease in the fatality and hospital admission rate of licensed drivers, from approximately 37 per 10,000 drivers aged 15–19 years in 1985 (pre-GDL) to 25 in 1990, and 20 in 1996. The authors conclude that the decrease in the crash fatality and hospital admission *rate* is a more important indicator of the effectiveness of the GDL system than the ongoing decrease in the number of crash-related injuries to young persons.

In summary, nighttime driving restrictions have been shown to effectively reduce the number and rate of crash involvements on the part of teenage drivers. A recent report describing a model GDL program for North America (Williams & Mayhew, 2002) recommended that unsupervised night driving by newly licensed drivers be restricted, with the pattern of nighttime crashes in the age group to which the GDL will apply used to determine the starting time of the restriction. The optimal recommended starting times were 9 p.m. or 10 p.m., with exemptions for work-related driving and driving to and from school or other nonrecreational activities.

Currently, 36 states have adopted the nighttime driving restriction ordinance. However, the criteria vary widely, ranging from the most relaxed (1 a.m.–5 a.m.) to the most stringent (sunset through sunrise). According to an Insurance Institute for Highway Safety (1999) report on US licensing systems for young drivers, seven states (Delaware, Idaho, Mississippi, New York, North Carolina, South Carolina, South Dakota) have nighttime driving restrictions during the intermediate stage of graduated licensing that begin at or before 10 p.m. and extend until at least 5 a.m. Twenty-nine states have nighttime restrictions that begin later than 10 p.m. and for six of those states, there is only secondary enforcement of the restriction. Fifteen states have no nighttime driving restrictions whatsoever. The minimum age at which the nighttime restrictions may be lifted varies from state to state, ranging from 16 to 18 years. Table 2 summarizes studies of nighttime driving restrictions in the context of full GDL programs.

As effective as nighttime driving restrictions may be in reducing crashes and injuries, the rate of compliance obviously plays a significant role in the level of their impact. Many younger drivers think that the chances of getting caught are very small and the enforcement of this restriction lies mainly in the hands of their parents. Fortunately, studies have shown that most American parents are in favor of this ordinance. The approval rates of this provisional measure were between 74% and 94% (Ferguson & Williams, 1996; Mayhew, Simpson, Ferguson, & Williams, 1998; Williams, Leaf, & Preusser, 1998; Williams, Nelson, & Leaf, 2002). In addition, a majority of the American

parents prefer a nighttime driving restriction starting at 10 p.m. or earlier.

3. Passenger restrictions

The second key component of graduated licensing systems is a restriction on the number of teenage passengers. Such passengers may influence the risk-taking behavior of teenage drivers, resulting in unsafe behaviors that lead to accidents and increased injury mortality not only for drivers, but also for all passengers in the vehicle. Fatal and nonfatal injuries to vehicle occupants make a substantial contribution to the overall burden of fatality in youth. Evidence of this impact is provided by FARS data. In 2001, passengers accounted for 57% of all fatal motor vehicle injuries in teenagers aged 13–19 years. Table 3 summarizes studies that evaluate passenger restrictions.

An analysis of national highway safety data suggests that having passengers in the car increases the likelihood of a fatal injury in young drivers (Chen, Baker, Braver, & Li, 2000). The relative risk of death among 16- and 17-year-old drivers who have at least one passenger in the car is significantly greater compared to driving alone. The risk increases with an increase in the number of passengers. Carrying at least three passengers results in a threefold increase in the probability of suffering a fatal injury (see Table 4).

In the same analysis, the excess risk remained significant for drivers with passengers under the age of 30 years (Table 5).

In their analysis of motor vehicle crashes in Kentucky, Aldridge, Himmeler, Aultman-Hall, and Stamatiadis (1999) determined that the risk of a crash is contingent upon the presence of passengers as well as their age. Young drivers (ages 16–20 years) were said to be less likely to cause a single- or two-vehicle collision when accompanied by adults and/or children and more likely to cause a crash when accompanied by their peers (ages 12–24 years).

The Insurance Institute for Highway Safety (1999) estimates that 275 lives (38% of driver fatalities) would be saved each year if young drivers complied with passenger restrictions and all passengers had to drive by themselves. If only 50% of young drivers were compliant with the law, only 150 lives would be saved.

Table 4
Relative risk of death for drivers by age and number of passengers, per million trips (Chen et al., 2000)

	One passenger	Two passengers	Three passengers
16-year-old driver	1.39 (95% CI 1.24–1.55)	1.86 (95% CI 1.56–2.20)	2.82 (95% CI 2.27–3.50)
17-year-old driver	1.48 (95% CI 1.35–1.62)	2.58 (95% CI 2.24–2.95)	3.07 (95% CI 2.50–3.77)

Table 5

Relative risk of death for drivers by number of passengers ages 13–19 years, per 1000 crashes (Chen et al., 2000)

	Passengers 13–19 years		Passengers 20–29 years	
	One passenger	Two passengers	One passenger	Two passengers
16- to 17-year-old driver	1.45 (95% CI 1.30–1.60)	1.71 (95% CI 1.50–1.94)	2.47 (95% CI 2.12–2.86)	2.71 (95% CI 1.78–4.10)

These findings and other data have been used to justify a provision included in many GDL programs that restricts the number of teen passengers during the intermediate licensing phase. Passenger restrictions vary from state to state in terms of their duration, the minimum allowed age of passengers, and the availability of an adult supervisor. In a large number of states, these restrictions do not apply to persons related to the teen driver and/or members of the driver's household. Also, the minimum driver age at which passenger restrictions may be lifted vary, ranging from 16 to 18 years. This divergence makes the study of the effectiveness of passenger restriction in preventing crash extremely complex and difficult.

Although passenger restriction may be a valid measure in reducing crashes and injuries, the rate of compliance again has significant impact on the level of its effect. However, unlike the nighttime driving restriction, passenger restriction has not received the same level of support from the teenage drivers and their parents. The approval rates of this provisional measure were between 43% and 72% (Ferguson & Williams, 1996; Ferguson, Williams, Leaf, Preusser, & Farmer, 2001; Williams, Ferguson, Leaf, & Preusser, 1998). It was observed, however, that experience with provisional restrictions seems to help increase the support and acceptance of these limits.

4. Recommendations

Although there seems to be enough evidence that nighttime driving and passenger restrictions are effective in decreasing injuries among teenage drivers and their passengers, especially in the context of a full graduated licensing system, several research questions need to be answered in order to better refine and optimize the impact of the provisional measures:

- Does the knowledge and behavior change, acquired during the provisional phases, have a sustaining effect?
- What is the optimal night period for driving restrictions?
- Will these provisional measures have the same effect on the younger and older beginning drivers?
- Through what mechanism does a provisional measure achieve its impact?

- How are the independent and interactive effects of these restrictions assessed?
- How does the compliance impact the overall effectiveness of these restrictive measures and what are the factors that influence compliance?
- How are the risks versus benefits of graduated licensing system best assessed?
- How is the impact of parental management of teen driving on the effectiveness of these restrictive measures captured?
- How will the type and quality of supervision provided to the teenage drivers impact the effect of these provisional measures?

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